

High Performance Torso Cooling Garment

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The concept proposed in this paper is to improve thermal efficiencies of the liquid cooling and ventilation garment (LCVG) in the torso area, which could facilitate removal of LCVG tubing from the arms and legs, thereby increasing suited crew member mobility. EVA space suit mobility in micro-gravity is challenging, and it becomes even more challenging in the gravity of Mars. By using shaped water tubes that greatly increase the contact area with the skin in the torso region of the body, the heat transfer efficiency can be increased. This increase in efficiency could provide the required liquid cooling via torso tubing only; no arm or leg LCVG tubing would be required. Benefits of this approach include increased crewmember mobility, reduced LCVG mass, enhanced evaporation cooling, increased comfort during Mars EVA tasks, and easing of the overly dry condition in the helmet associated with the Advanced Extravehicular Mobility Unit (EMU) ventilation loop currently under development.

This report describes analysis and test activities performed to evaluate the potential improvements to the thermal performance of the LCVG. Analyses evaluated potential tube shapes for improving the thermal performance of the LCVG. The analysis results fed into the selection of flat flow strips to improve thermal contact with the skin of the suited test subject. Testing of small segments was performed to compare thermal performance of the tubing approach of the current LCVG to the flat flow strips proposed as the new concept. Results of the testing is presented along with recommendations for future development of this new concept.

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